



**What's Indiana General been cooking up
in memory products?**

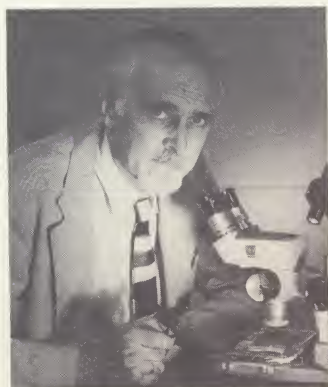




Indiana General discovered memory cores

Today, Indiana General is the largest independent producer and seller of memory cores in the world. But it's always been that way.

It started in the late 1940's.



IGC scientists, led by Dr. Albers-Schoenberg, invented the square-loop ferrite memory core.

Dr. Ernst Albers-Schoenberg of Indiana General's Electronics Division in Keasbey, New Jersey, had long been considered a leading authority and pioneer in the development of ferrite materials. How-

ever his invention of a unique ferrite material which exhibited a square hysteresis loop proved to be one of his most valuable contributions.

From this new material came the ferrite memory core, the first practical solution to the problem of data storage. The first application for IGC's new memory core was in M.I.T.'s Whirlwind I computer. Other early

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applications for IGC memory cores included Univac's first commercial computer, and the SAGE Early Warning System.

The production of memory cores soon led Indiana General into the stringing of planes. Logically, the next step was the assembly of complete memory arrays. This beginning, and a continued program of advance planning emphasizing material development, core technology and stacking techniques, has helped make Indiana General a leader in the field of memory products.

This specialization has helped to produce 63 IGC patents related to ferrite materials and devices, which have found wide application in the computer and general electronics fields. Other IGC developments have been designed to solve specific problems. For example, the continuously strung Microstack®, a highly reliable, compact memory module for military and aerospace applications.

Support for every phase of our operation is available from other IGC divisions. Being the world's largest manufacturer of magnetic materials has many advantages.

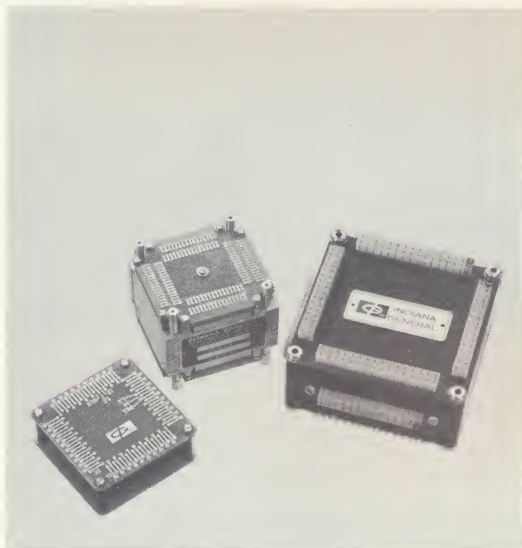
On the following pages are highlighted IGC's Memory Products' facilities and capabilities at our Electronics Division. This operation, a few minutes south of Newark, covers over 100,000 sq. ft., and includes research, engineering, manufacturing, assembly and testing.

In 1965, Ferromagnetica, S.A. was formed in Mexico City. This new company is jointly owned with a well-known Mexican manufacturer of electronic components. It was established specifically to string memory planes for large volume requirements. The excellent

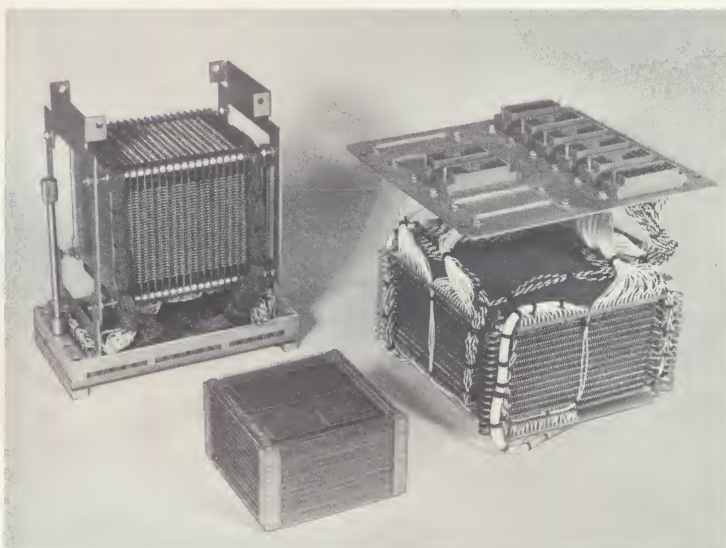
reliability records of planes strung at this operation bear out the success of IGC's quality control programs at Ferromagnetica.

The computer, as we know it today, with its massive storage capacity and nanosecond speeds, would be impossible without Indiana General's initial contribution seventeen years ago. In fact, today, practically every manufacturer of memory devices and data processing equipment uses Indiana General memory cores, or is an IGC licensee.

Pretty good when you consider Indiana General started at the core of the problem.

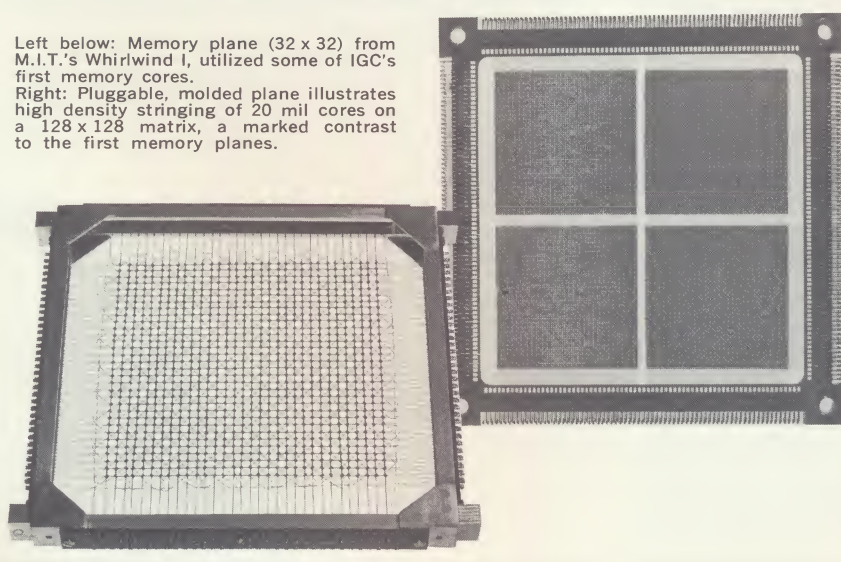


Microstacks are available in a wide range of packages for applications in commercial, industrial and military systems.



IGC memory stacks find application in a wide variety of commercial, industrial, and military data processing equipment. Shown above (left) printed circuit plane stack, (right) molded plane stack, and pluggable, molded plane stack.

Left below: Memory plane (32 x 32) from M.I.T.'s Whirlwind I, utilized some of IGC's first memory cores.
Right: Pluggable, molded plane illustrates high density stringing of 20 mil cores on a 128 x 128 matrix, a marked contrast to the first memory planes.



Assembling frames for Polaris missile memory stack.





Indiana General cooks up about 20 million cores a week

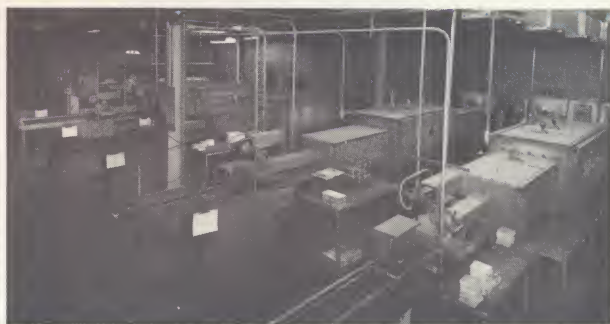


IGC has the widest selection of memory cores and multiaperture devices at its fingertips (from 15 to 230 mils).

At present, Indiana General has the capacity to press, fire and test more than a billion memory cores annually. And the quantities will increase. No one produces and sells more memory cores than Indiana General.

IGC also has the widest range of core materials. Over thirty standard materials, covering a full range of standard and wide-temperature cores (spanning a 100° C range), as well as multiaperture devices. Sizes include 15, 20, 30, 50 and 80 mils O.D.—and up to 230 mils. Switching times from under 100 nanoseconds to over 4 microseconds.

Repeatability, the assurance of obtaining identically operating cores on repeat orders, is another benefit of IGC's core capability. IGC's in-process quality control program includes such steps as 100 percent testing of electrical parameters; with AQL testing before and after 100% test. MIL Standard 105D inspection level II is used for sampling.



Tunnel kilns fire more than a billion cores a year.

Our background in core technology helps us anticipate your problems and requirements. IGC design engineers work with systems designers to arrive at the optimum core for every application. No one offers a wider selection of cores — standards as well as specials — than Indiana General. Research and engineering are constantly developing new and improved core materials. Manufacturing Engineering has a continuous program to reduce costs by improving yields. In the last five years, the average price of memory cores has been reduced nearly 70%!

Nobody can get to the core of the system designer's problem better than Indiana General. After all, we invented the core.

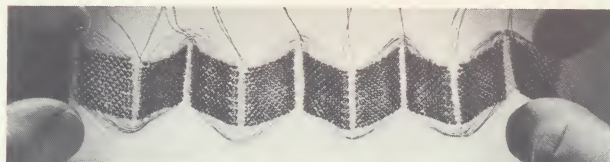
Memory cores pass physical, as well as electrical tests.





Indiana General is in the stack business in a big way

In memory planes and stacks, Indiana General's reputation is a reflection of competent and experienced electrical, mechanical and technical staffs. We started when data processing was just beginning. And we've grown right along with its rapid-paced growth.



Compact folded array, developed by IGC, folds together to form complete Microstack; reduces solder connections by over 80%.

In fact, Indiana General has made many significant contributions to the state-of-the-art. Like the Microstack, an IGC innovation. Utilizing the folded array mat with continuous wiring, the Microstack has over 80% fewer solder connections than conventional printed circuit frame-type stacks. The result is a high density package, with greater reliability and resistance to shock and vibration.

The Microstack is available in three distinct packages. The commercial version has top and bottom printed circuit boards, which serve to stack individual modules to the desired bit length.

The industrial Microstack utilizes a unique packing technique which permits individual modules to be simply plugged together. Bit length can be increased or decreased in a matter of minutes. Military versions of the Microstack concept can be designed to operate reliably in extremes of temperature, humidity, altitude, vibration, shock and corrosive environments. IGC's experience in packaging techniques has been the key to hun-

dreds of successful Microstack applications.

Indiana General has also developed and engineered advanced memory frame designs. Like molded types, for high density stringing, mechanical strength and resistance to acid, fungus, moisture and temperature. A plug-gable, molded plane requires no soldering between frames. In the field of mass memory systems, a new "hinged frame" stack has recently been developed—capacity, over two million bits; price, less than one cent per bit.

Core testing, as well as plane and stack testing procedures are stringent. Measurements of stack parameters over the operating temperature range include switching time, output, peaking time, and amplitudes for binary one and zero. Measurements are taken on input patterns that include all ones, all zeros, double checkerboard (worst case noise) and its complement.

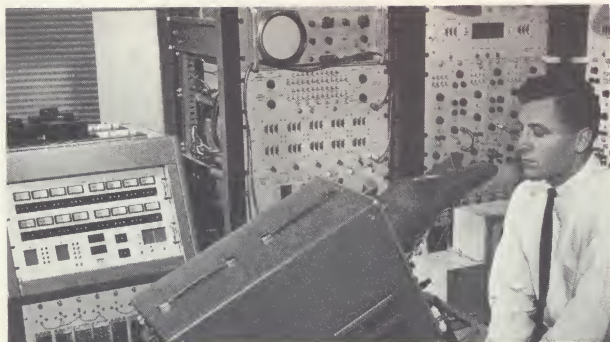
No matter how you stack it, you can look to Indiana General for new ideas backed by years of experience.



Microstacks meet some of the most stringent military and NASA requirements. Above, Microstack is undergoing vibration tests.



Indiana General means space age reliability



To assure the highest product reliability, IGC maintains the most advanced test methods for planes and stacks.

Indiana General's product reliability extends to serving the needs of military, industrial and commercial applications. For example meeting some of the most stringent military and NASA requirements* for projects such as the Apollo program's Lunar Excursion Module, and the Minuteman weapons system. Or designing for light shock and vibration as well as changeable environmental specifications in process control applications. And providing high volume stack production with optimum repeatable characteristics.

In short, IGC can offer you the best core, plane and stack in a package suited to your specific requirements. Plus some extras. Such as special wiring techniques to keep stack noise and propagation delays to a minimum. Mechanical engineering in depth to solve every conceivable packaging problem. And assistance in integrating IGC's memory stack with your electronics.

Project control is vital. That's why an engineer is assigned to supervise and monitor

the entire manufacturing process—from beginning to end. A further assurance of quality IGC products.

Production employees undergo a six weeks training program using practice frames until high level quality tests are passed. Our solder school consists of an intensive one week course, and is NASA approved. IGC's entire quality control system has military approval, and is under constant surveillance by a resident government quality representative.

IGC's quality control is complete. Down to development of test and methods procedures used during manufacturing cycles, and the calibration and approval of all electrical and mechanical test measurement equipment. Our Q. C. Manual and Inspection Plan are used in conjunction with every production order—and are also military approved. Quality control is documented on traveler cards, from the first manufacturing step through to packing and shipping.

IGC also maintains quality survey reports and rating on our own vendors to assure you that every component contributes to making IGC planes and stacks the finest quality product.

This is Indiana General Memory Products, from the core up.

A complete technical data package on IGC cores, planes and stacks is yours for the asking. Write to Indiana General Corporation, Electronics Division/Memory Products, Keasbey, New Jersey.

* MIL-E-16,400; MIL-E-5400; MIL-E-5272C Procedure X-11, Condition C and D; MIL-T-5422E paragraph 4.4.; NPC 200-3.

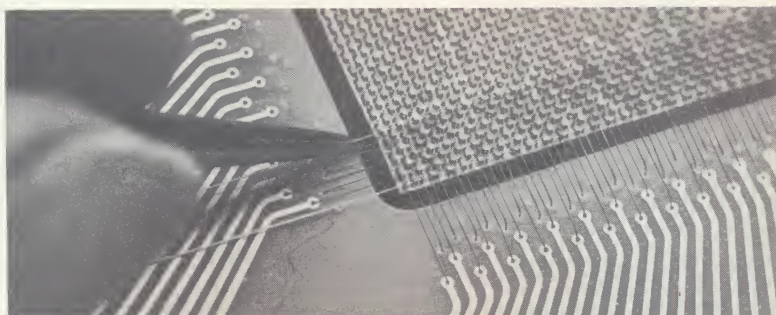


Continuously strung, folded array mats near completion for Microstack module to be used in the Minuteman Missile System.

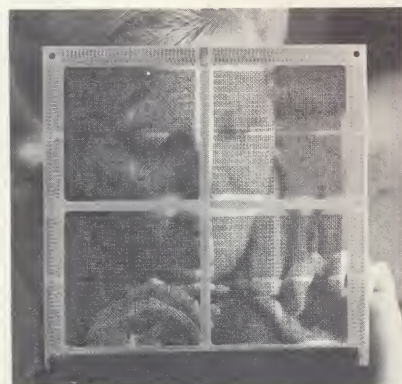
Stringing area at Keesbey plant.



Dust-free conditions are provided during final assembly operations of stacks to further assure high reliability.



Close-up view of stringing operation illustrates high density core spacing.



Inspector checks out memory plane prior to electrical testing.



Weighing of cores, in preparation for shipping.



Quality control checks every plane, searching for stringing inaccuracies or broken cores.

INDIANA GENERAL

MAGNETICS IS OUR BUSINESS

Electronics Division: Keasbey, New Jersey

Ferramic® (ferrite) parts and assemblies, memory cores, planes and stacks

Ferromagnetica, S. A. Mixcoac: Mexico City, Mexico

Memory products and Ferramic® (ferrite) parts and assemblies

Magnet Division: Valparaiso, Indiana

Alnico, Indox® (ceramic) and Cunife permanent magnets, magnetizing and test equipment

Electro-Mechanical Division: Oglesby, Illinois

High reliability precision fractional horsepower motors

Magnetic Equipment Division: Milwaukee (Cudahy), Wisconsin

Permanent and Electromagnetic materials handling and separation equipment

BMS Carbide Specialties Division: Boonton, New Jersey

Precision carbide tools and dies

The Indiana Steel Products Company of Canada Ltd.: Kitchener, Ontario

Permanent magnets and high alloy castings

Corporate Headquarters: Valparaiso, Indiana